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DEPARTMENT OF LAND SURVEYING AND GEO-INFORMATICS
土地測量及地理資訊學系

LSGI Public Lecture Series

"Earthquake magnitude forecasting from interseismic locking distribution along the subduction megathrust"

Overview

It was our pleasure to invite Dr Hongfeng Yang, Assistant Professor, Earth System Science Programme, The Chinese University of Hong Kong, to deliver a seminar of the LSGI Public Lecture Series on 22 Mar 2019.

Earthquake magnitude forecasting from interseismic locking distribution along the subduction megathrust

Reducing losses from megathrust earthquakes and tsunamis demands accurate estimate of future rupture scenarios. Given recent advances in geodetic data, interseismic locking models along the megathrust now become useful to qualitatively evaluate future earthquake potential. However, an individual earthquake's true rupture potential is challenging, as it depends on more than just a static image of prior locking. Here, we test the determinism of interseismic locking models using spontaneous rupture simulations and the well-refined and understood processes associated with the 2012 Mw 7.6 Nicoya earthquake. To do so, we estimate initial megathrust stress from locking, then initiate spontaneous ruptures, testing different nucleation points. For ruptures initiating at the hypocentre of the 2012 Nicoya earthquake, we find scenarios that approximate the coseismic slip distribution and final earthquake moment magnitude derived from seismic and geodetic observations. However, we find that only ~40% of nucleations develop into large earthquakes of Mw>7.2 based on present interseismic locking models. Of these events, those nucleated from deeper depths have a tendency for larger-amplitude shallow slip, suggesting increased tsunami potential. Furthermore, irrespective of the input locking models we do not observe rupture scenarios of earthquakes with intermediate magnitudes between 6 and 7, a result consistent with observations outside of the aftershock period in Nicoya. The results of hypocentre-dependent earthquake magnitudes and tsunamigenic potential not only pose challenges in estimating rupture extents from locking models, but also underscore the significance of quantitatively evaluating seismic and tsunami hazard in subduction zones.